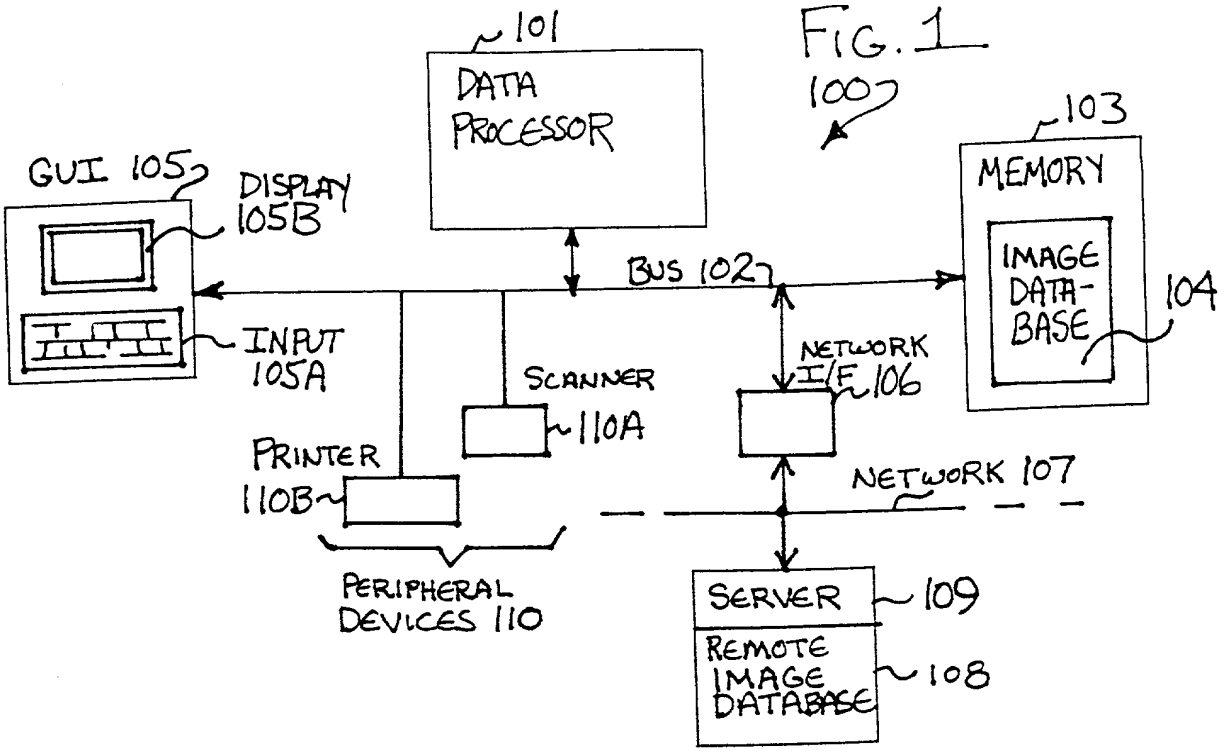
101
DATA PROCESSOR
100
103
MEMORY
GUI 105
DISPLAY 105B
INPUT 105A
BUS 102
IMAGE DATA-BASE
104
NETWORK I/F 106
SCANNER
110A
PRINTER
110B
NETWORK 107
PERIPHERAL DEVICES 110
SERVER
109
REMOTE IMAGE DATABASE
108

FIG. 1

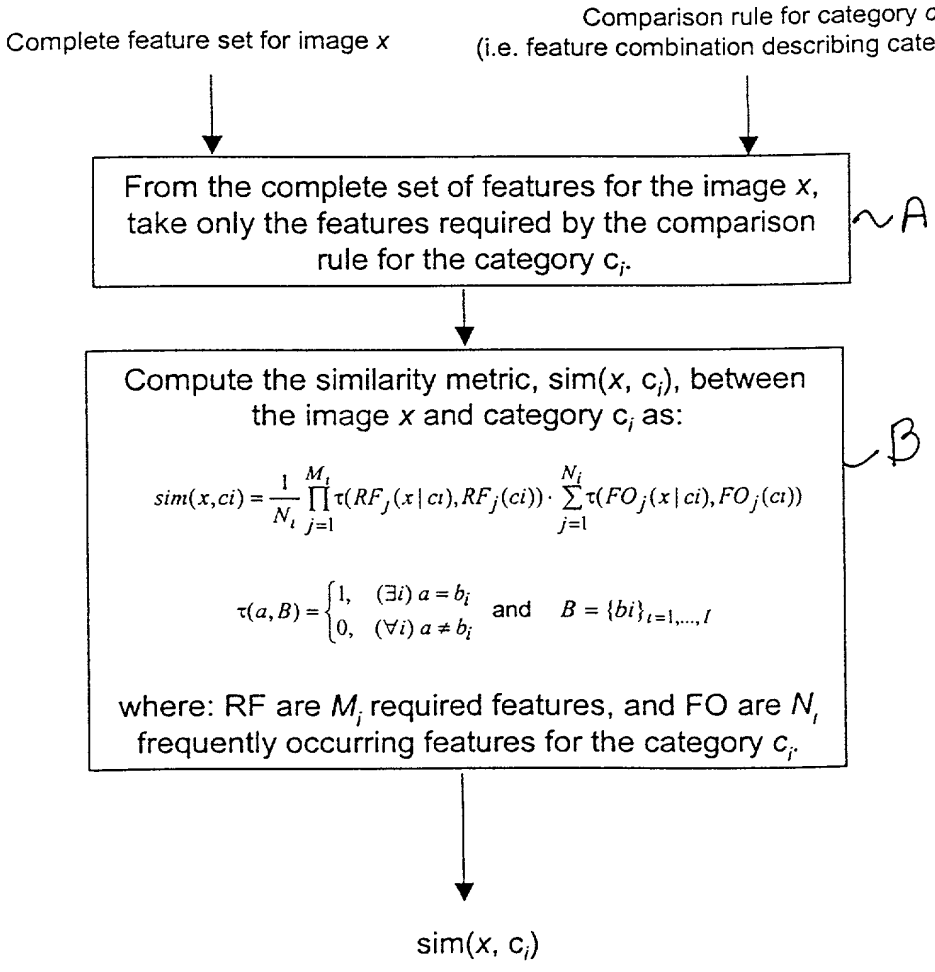
Complete feature set for image x
Comparison rule for category c_i (i.e. feature combination describing category c_i)
From the complete set of features for the image x, take only the features required by the comparison rule for the category c_i.
A
Compute the similarity metric, sim(x, c_i), between the image x and category c_i as:
$$sim(x,ci) = \frac{1}{N_i}\prod_{j=1}^{M_i}\tau(RF_j(x\mid ci), RF_j(ci)) \cdot \sum_{j=1}^{N_i}\tau(FO_j(x\mid ci), FO_j(ci))$$
$$\tau(a,B) = \begin{cases} 1, & (\exists i)\ a = b_i \\ 0, & (\forall i)\ a \neq b_i \end{cases} \quad \text{and} \quad B = \{bi\}_{i=1,\ldots,I}$$
where: RF are M_i required features, and FO are N_i frequently occurring features for the category c_i.
B
sim(x, c_i)

FIG. 2

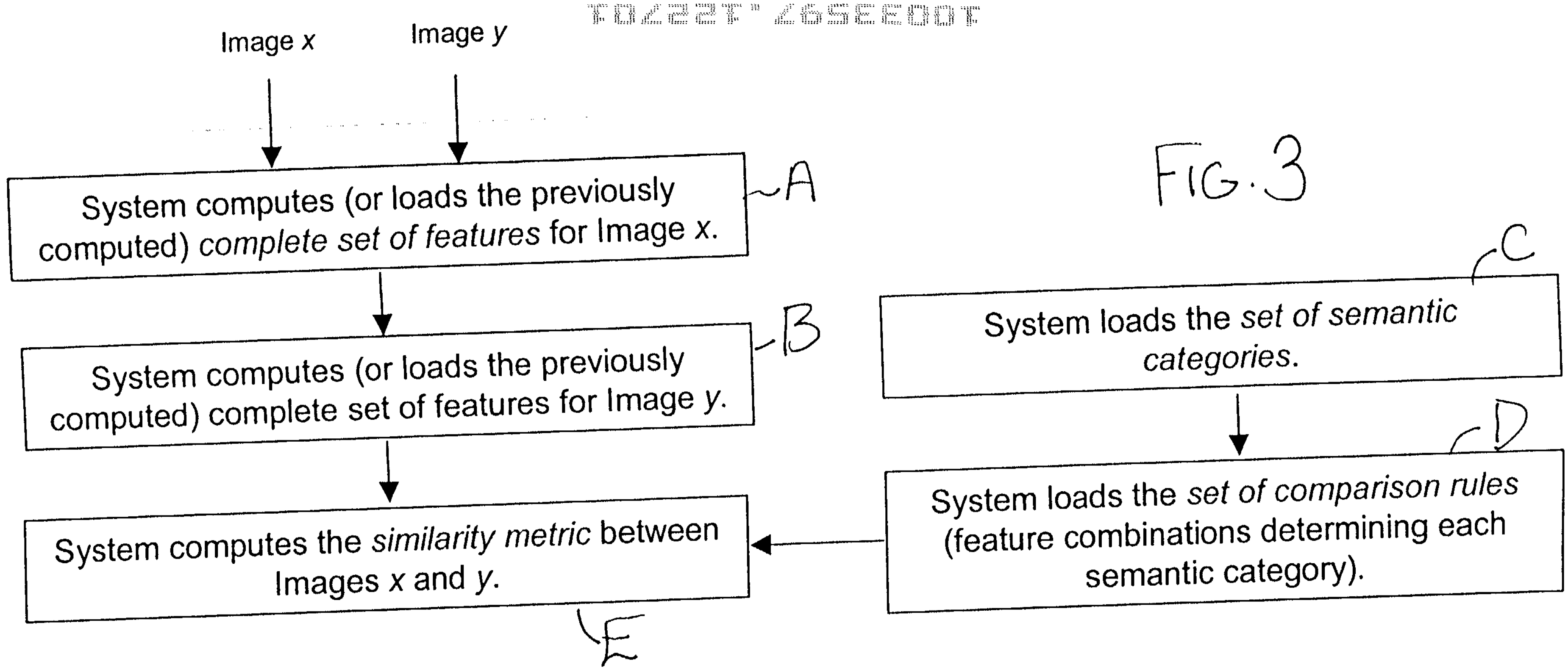
Image x
Image y
System computes (or loads the previously computed) complete set of features for Image x.
A
System computes (or loads the previously computed) complete set of features for Image y.
B
System computes the similarity metric between Images x and y.
E
System loads the set of semantic categories.
C
System loads the set of comparison rules (feature combinations determining each semantic category).
D

FIG. 3

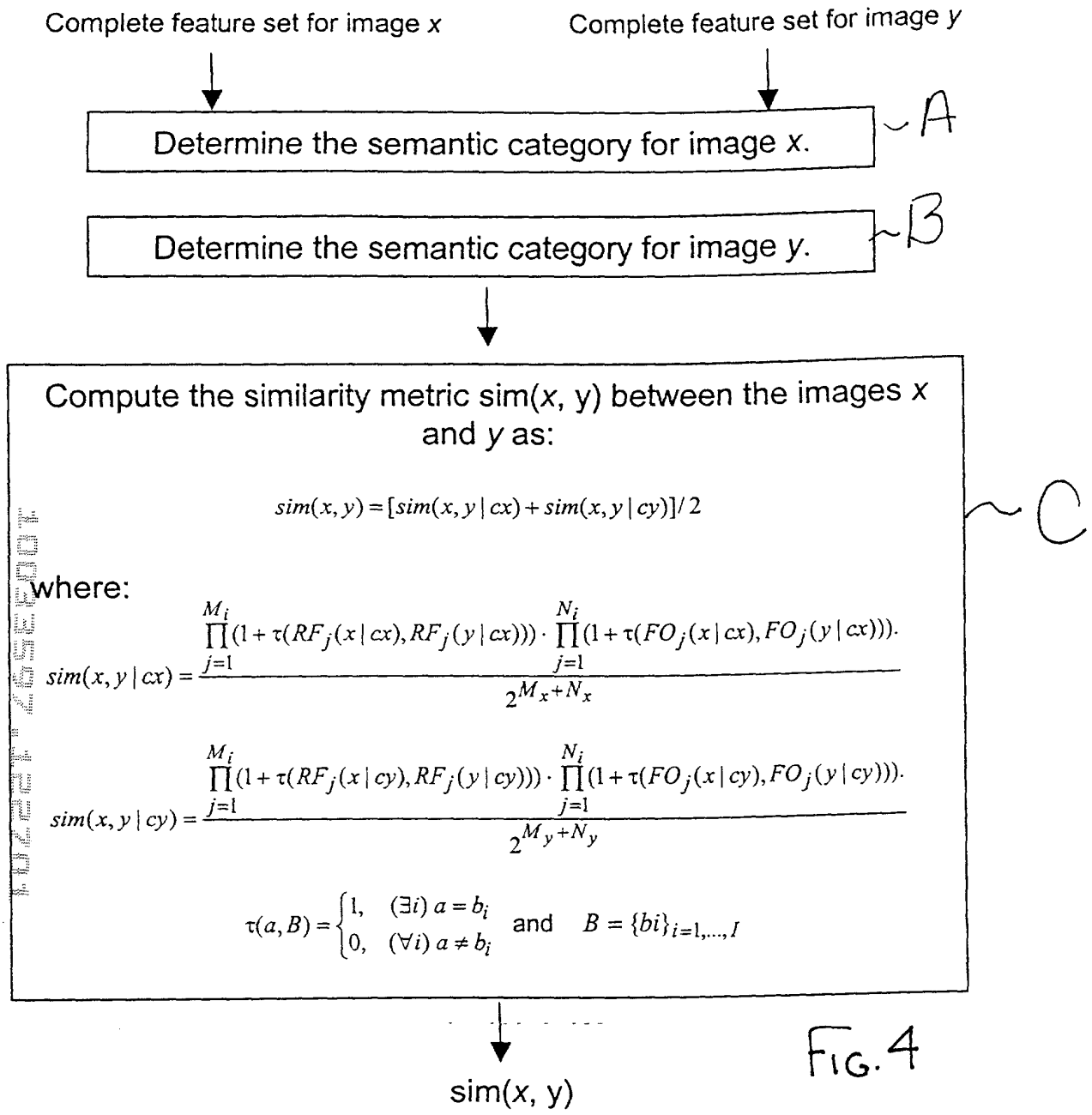
Complete feature set for image x
Complete feature set for image y
Determine the semantic category for image x.
A
Determine the semantic category for image y.
B
Compute the similarity metric sim(x, y) between the images x and y as:
$$sim(x,y) = [sim(x,y \mid cx) + sim(x,y \mid cy)]/2$$
C
where:
$$sim(x,y \mid cx) = \frac{\prod_{j=1}^{M_i}(1+\tau(RF_j(x \mid cx), RF_j(y \mid cx))) \cdot \prod_{j=1}^{N_i}(1+\tau(FO_j(x \mid cx), FO_j(y \mid cx)))}{2^{M_x+N_x}}$$
$$sim(x,y \mid cy) = \frac{\prod_{j=1}^{M_i}(1+\tau(RF_j(x \mid cy), RF_j(y \mid cy))) \cdot \prod_{j=1}^{N_i}(1+\tau(FO_j(x \mid cy), FO_j(y \mid cy)))}{2^{M_y+N_y}}$$
$$\tau(a,B) = \begin{cases} 1, & (\exists i)\ a = b_i \\ 0, & (\forall i)\ a \neq b_i \end{cases} \quad \text{and} \quad B = \{bi\}_{i=1,\ldots,I}$$
sim(x, y)

FIG. 4

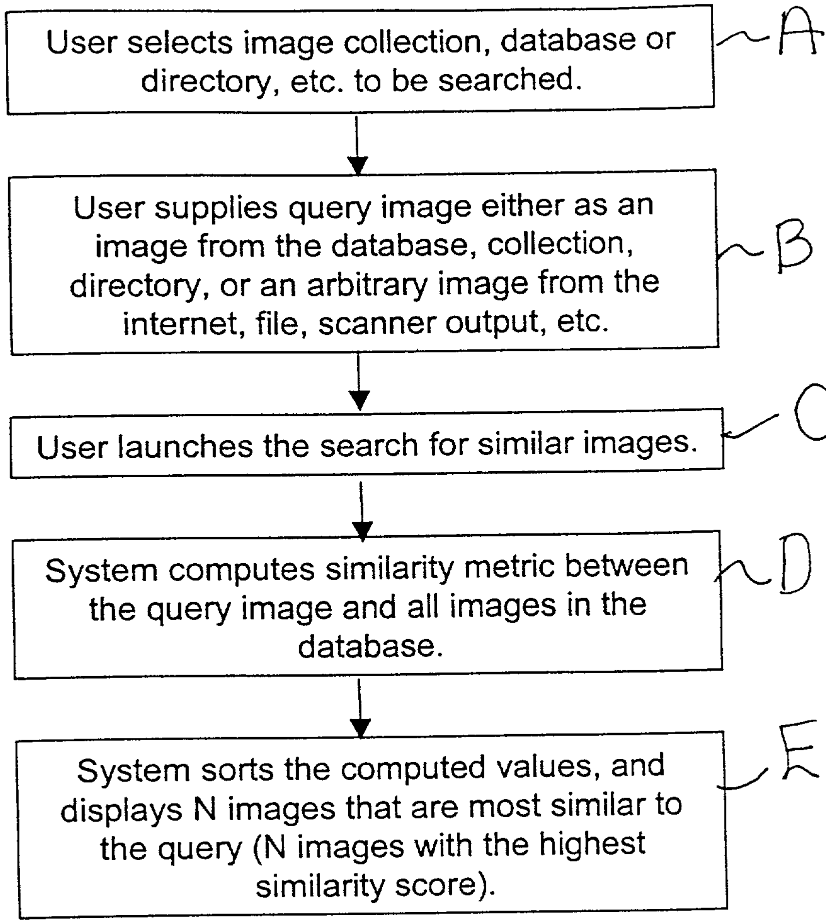
User selects image collection, database or directory, etc. to be searched.
A
User supplies query image either as an image from the database, collection, directory, or an arbitrary image from the internet, file, scanner output, etc.
B
User launches the search for similar images.
C
System computes similarity metric between the query image and all images in the database.
D
System sorts the computed values, and displays N images that are most similar to the query (N images with the highest similarity score).
E

FIG. 5

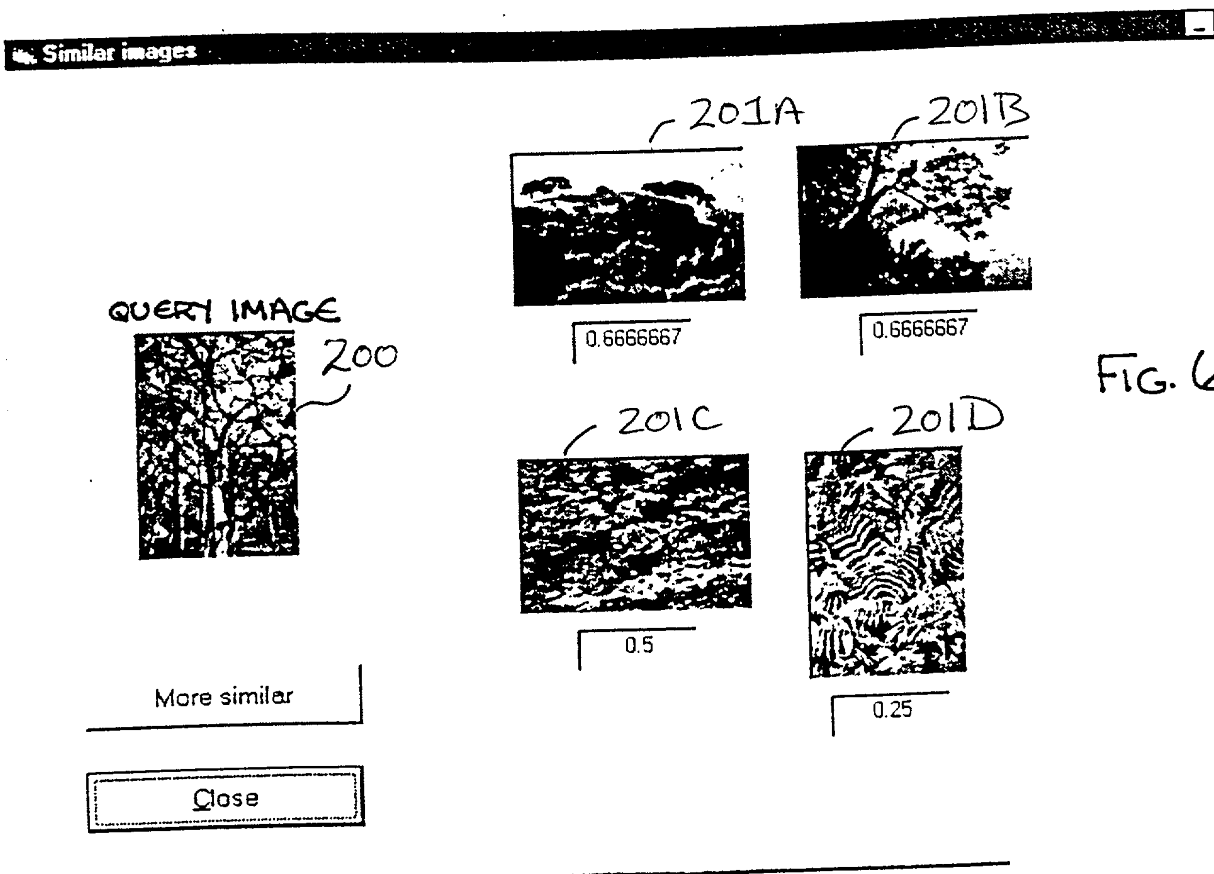
Similar images
QUERY IMAGE
200
201A
201B
0.6666667
0.6666667
201C
201D
0.5
0.25
More similar
Close

FIG. 6

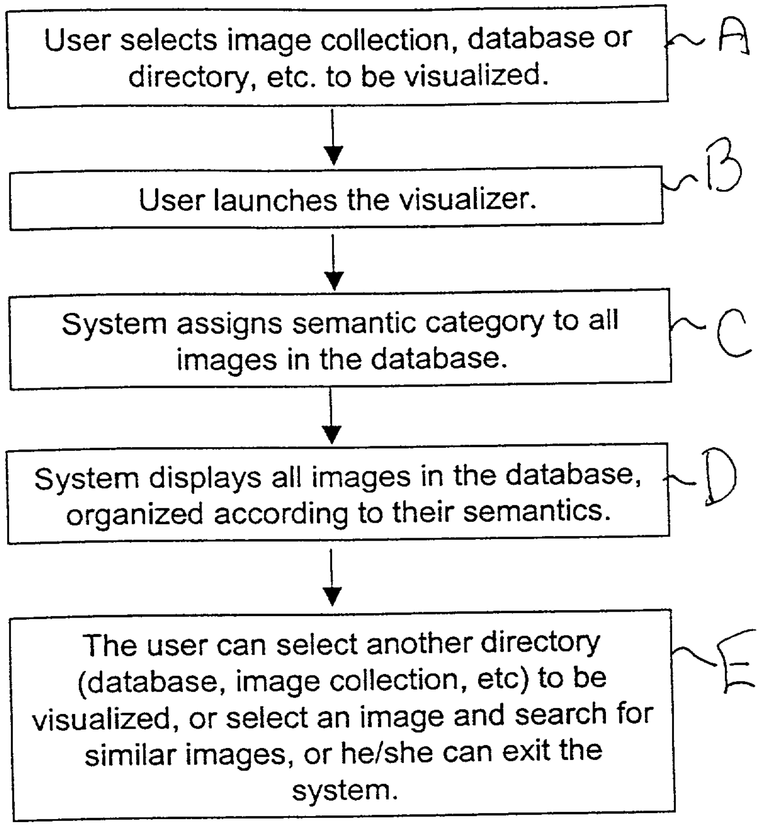
User selects image collection, database or directory, etc. to be visualized.
A
User launches the visualizer.
B
System assigns semantic category to all images in the database.
C
System displays all images in the database, organized according to their semantics.
D
The user can select another directory (database, image collection, etc) to be visualized, or select an image and search for similar images, or he/she can exit the system.
E

FIG. 7

FIG. 8

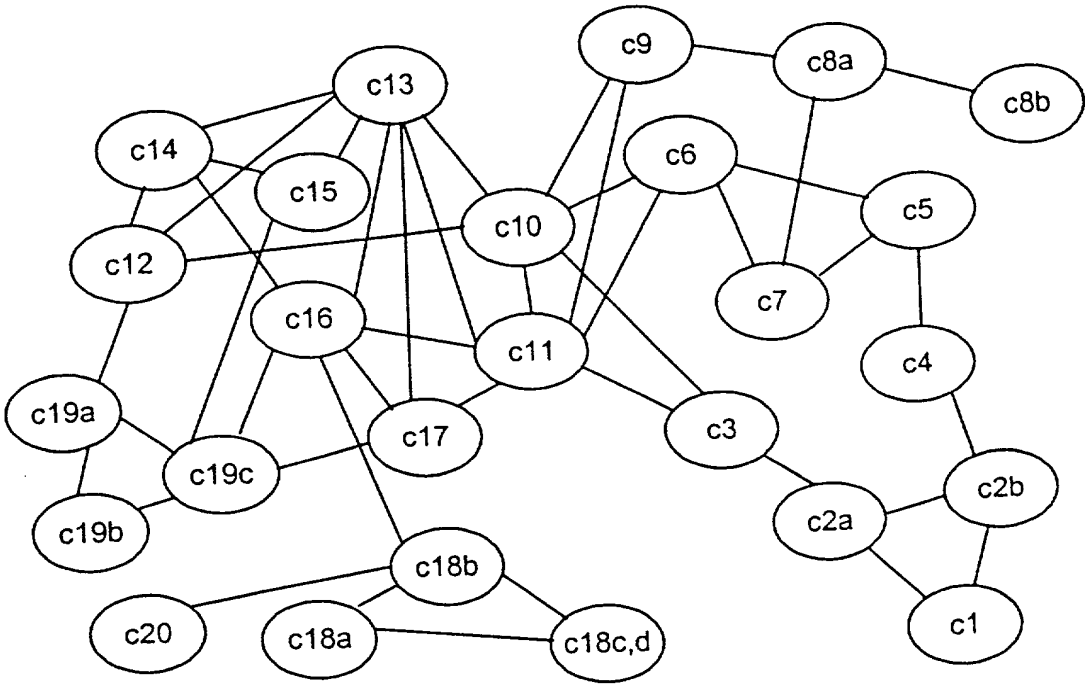
c9
c8a
c8b
c13
c14
c15
c6
c5
c10
c12
c7
c16
c11
c4
c19a
c17
c3
c19c
c2b
c2a
c19b
c18b
c20
c18a
c18c,d
c1

FIG. 9